

Overall outcome of Modified Radical Mastoidectomy (MRM)

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Abstract

Aims

To compare overall findings of our Modified Radical Mastoidectomy (MRM) practice with the available contemporary standards of international recognition.

Design and Methodology

The cohort included the patients who underwent Modified Radical Mastoidectomy from 2013 to 2018 by the author, who were subjected to a retrospective study. The details obtained from clinic reports were preoperative and postoperative hearing (documented to the end of the fourth post op year), and findings that were documented intraoperatively and post operatively in successive clinic visits. The parameters analysed were hearing improvement, disease extension, anatomical variations, immediate and late post-operative complications.

Results


There were no evidence of recurrence following the surgical intervention. Postoperative mean air-bone gap had reduced by 9.5dBHL, 5dBHL, 7.44dBHL 4.9dBHL 4.1dBHL 3.75dBHL and 8.18dBHL at 0.125kHz, 0.250kHz, 0.5kHz, 1kHz, 2kHz, 4kHz and 8kHz respectively. Disease involvement was found in Attic, Antrum, Sinus tympani, facial recess, mesotympanum, oval window and posterior sinus, supra tubal recess, sinodural angle cells, sinus sub tympanum, external ear canal, in the descending order of occurrence. 36 audited patients achieved dry ears by the end of second year though some had at least one intermittent wet episode and 4 had continuous persistent wet ears. Intraoperative findings analysis showed 2.5% were observed with perilymph leak, 27.5% had erosion of malleus head by disease, 55% had erosion of incus, 90% intact suprastructure, 97.5% had intact stapes foot plate, 15% had significant dural overhang, 10% had exposed facial nerve, 10% had anterior sigmoid sinus and 2.5% had exposed dura. Immediate post intraoperative complications of 7.5% HB grade 1 facial nerve palsy, 42.5% taste alteration, 5% CSF leak, 25% complaining of disturbing head ache, 7.5% having exposed dura (iatrogenic), 7.5% had dressing removed due to risk of pressure necrosis of pinna or developing Facial nerve palsy and 2.5% (one) patient had the meatus migrating downward due to a connective tissue problem of skin. During post-operative period stitch abscess was noted among 5%, achieved self-cleaning dry ear in 15%, wax build up in the dry ear in 10%. However, over 50% patients had minimum of 1 episode of wet ear in this period. Meatal stenosis and keloid development was noted among 10% and, graft perforation among 20% and 2.5% (one) wound dehiscence. During post-operative period 7.5% developed BBPV and similar percentage had caloric effect during packing of the cavity while 22.5% developed caloric effect during suction of the cavity.

Conclusions

The improvements in hearing when adjunct with Tympanoplasty in this audit keep up with recent compared studies. Further its ability to safely achieve a disease free ear is endorsed and complemented by the low complication rates.

Key words: Cholesteatoma, Hearing loss, Mastoid, Tympanoplasty, Ossiculoplasty

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Introduction

Surgical procedures that remove posterior wall of the external auditory canal are named open cavity procedures.

⁽¹⁾ This cluster includes canal wall down mastoidectomy (CWDM), radical mastoidectomy, modified radical mastoidectomy and Bondy mastoidectomy. By bringing down the posterior wall of the mastoid cavity the latter is exteriorized with the aim of surveillance for recurrence, drainage of infection and easy access to remote corners of the cavity. However, the canal wall down technique inherits its unique disadvantages due to altering the anatomy of ear. Canaloplasty and Meatoplasty make it difficult in fitting hearing aids, predispose to caloric vertigo and alteration in appearance and position of pinna. ⁽²⁾ In addition, the presence of many clinic follow-ups build up a cumulative burden with increasing number of cases performed.

Methods

This audit took place at Trincomalee District General Hospital (DGH) operation theatres and clinics. Ethical clearance was obtained and informed written consent was taken for all patients. The audit was conducted from 2013 to 2018 and included all patients who underwent canal wall down modified radical mastoidectomy for cholesteatoma by the author.

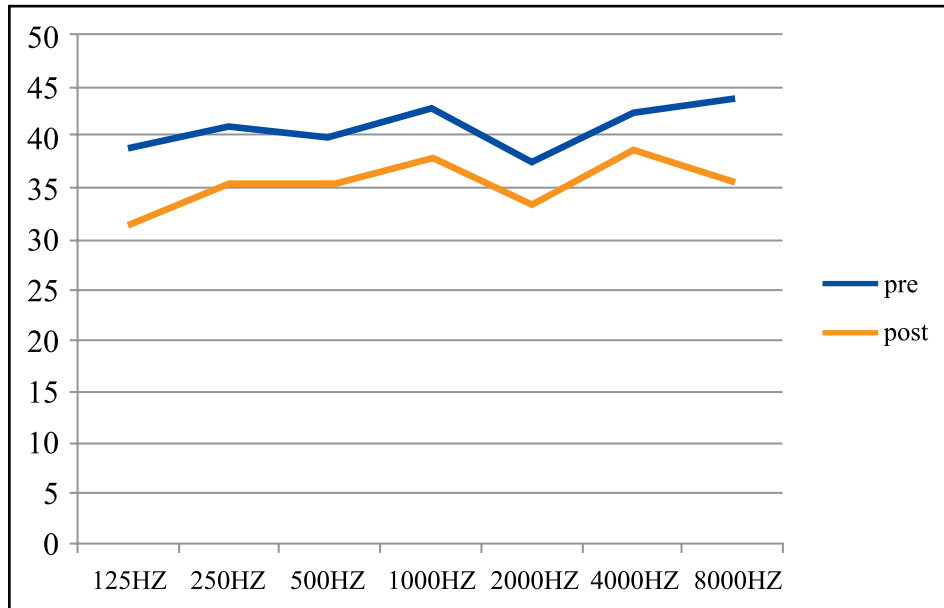
Patients who were operated for cholesteatoma using a Modified Radical Mastoidectomy method and followed up for four years were selected according to the criteria of the research. The cohort comprised of 40 patients. The patients were followed up weekly for first two months and every other week for next four months. The second six months had consecutive monthly visits followed up by every third month routine visits for next six months and they also had a six-month interval examination under microscopy. All patients had an average of 24 visits. The data was entered in 'real time' onto a Microsoft Excel Spread sheet. Intra operative findings were recorded in the immediate post-operative period.

Inside out technique with temporalis facial graft and canal meatoplasty was used. Type three tympanoplasty with cartilage augmentation of posterior upper quadrant of middle ear, TORP and type four Wolfstein tympanoplasty were used for establishment of hearing in a single stage operation. Continuous vertical mattress suture was used for skin with an absorbable material been preferred for paediatric population.

Facial nerve injury, chorda damage, CSF leaks, head ache and temporomandibular joint injury and Sigmoid sinus damage were evaluated inter-operatively and at the fourth post-operative week. BPPV and caloric effect was documented from the first week onwards. Wound dehiscence, cavity clearance which includes stich abscess, wet ear, graft perforation, infections, polyps, beads of keratin, meatal stenosis, keloids, wax build up and self-cleaning dry were ticked in every visit. Hearing assessment was done by comparing Air-Bone gap with preoperative findings in end of first year.

Results

Of the forty patients, there were 15 males and 25 females. Their age ranged from 7 years to 53 years. There was no recurrence detected in the patients audited. The hearing was assessed by comparison of pre and post mean air bone gaps across 125Hz,250 Hz,500Hz,1000Hz,4000Hz and 8000Hz and a reduction was noticed though it was not significant, according to Students T-Test values. (table 1)



(Y axis Air -Bone gap in dB,X axis frequencies checked in Hz)

Extension of disease was assessed intra operatively using an operating microscope and otoendoscope and documented. The below table (Table 2) summarises the extension in the form of Attic, Antrum, Sinus tympani (area between ponticulus and subiculum), facial recess (area lateral to facial nerve and medial to bony annulus), mesotympanum, oval window and posterior sinus (area anterior and superior to ponticulus), supra tubal recess (area anterior to cog in anterior attic), sinodural angle cells, sinus sub tympanum (area in retro tympanum from subiculum to finiculus.) were separately scrutinized.

Involvement	Number of patients
Central Mastoid air-cells	26(65%)
Attic	25(62.5%)
Antrum	21(52.5%)
Sinus tympani	20(50%)
Facial recess	20(50%)
Oval window and posterior sinus	20(50%)
Mesotympanum	18(45%)
Supratubal recess	18(45%)
Sinodural angel cell	13(32.5%)
Sinus sub-tympanum	10(25%)
Round window	10(25%)
hypotympanum	9(22.5%)
Mastoid tip cell	9(22.5%)
Dura	6(15%)
External ear canal	4(10%)

Table 2 – Extent of disease

Intraoperative findings in addition to the extent of cholesteatoma was recorded under the following categories. (Refer Table 3)

Findings	Number of patients
Perilymph leak	1
Erosion of Malleus head	11
Erosion of Incus	22
Intact Stapes supra structure	35
Intact stapes foot plate	39
Dural overhang	14
Exposed facial nerve	4
Anterior Sigmoid sinus	4
Facial nerve overhang	3
Exposed dura	1

Table 3 – Other notable anatomical variations

Surgical procedures that were executed inside the middle ear cavities for hearing preservation were ossiculoplasty 87.5% (35 Patients) with type three Tympanoplasty with cartilage reinforced under the temporalis facial graft, 7.5% (3 Patients) TORP and 5% (2 Patients) type IV Tympanoplasty.

In the processes of cholesteatoma clearance intra operative surgical procedures on ossicles including removal of malleus head 57.5% (23 Patients), incus removal 75% (30 Patients) were performed. The skin and soft tissue Meatoplasty was done with absorbable suture material with continuous vertical mattress sutures in 80% including all under 18 years of age.

Immediate post-operative complications were noticed and were attended to immediately. However, there were no major complications. 3 patients (7.5% of the cohort) developed grade one House-Brakmann facial nerve palsy and were immediately treated with steroids, removal of dressing and evacuation of the antibiotic impregnated wick releasing the pressure on the nerve. 42.5% (17 patients) had taste alteration due to damage to chorda-tympani. Two patients (5%) developed iatrogenic intraoperative CSF leak from tegmen over the attic, consequent to application of monopolar diathermy and were repaired with overlay cartilage grafts reinforced with a temporalis facial graft.

Almost a quarter of the patients recovered from anaesthesia with a disturbing headache and were kept under vigil for intracranial complications such as pneumocephalus (with surveillance of pulse, X-ray skull) and treated with analgesics. 3 patients developed discoloration of pinna with a threat of pressure necrosis and were treated with prompt removal of cotton crape bandage resolving it.

In the late post-operative period, the following post-operative complications were noted in the skin. Two patients (5%) developed stitch abscesses and removal of skin sutures with oral antibiotics managed to resolve it. One patient (2.5%) developed a wound dehiscence and required secondary suturing. Keloid formation in the post aural scar was noted in 4 patients (10%) and unfortunately it did not respond satisfactorily to any treatment. However, the non-expanding nature and the camouflage due to its location did not make it a worrying issue for the patients. One child (2.5%) developed a meatal stenosis due a pre-existing connective tissue disorder of skin. When considering the health of the 'neocavity' 6 patients (15%) had a self-cleaning dry ear by end of the second year. A further 4 patients (10%) developed dry cavities, although wax collection in the cavity demanded their clinic attendance even by the end of this period. Amongst another 8 patients (20%) had a complication in the form of graft perforation which required further nursing. However, more than half had single or multiple attacks of wet ear in the absence of recurrence, which became frustrating. Making matters worse most of them had no attributable cause such as head and neck sepsis. A few who had allergic rhinitis were treated aggressively without much success.

During the follow up, 3 patients (7.5%) developed BPPV (Dix-hall pike test positive) in the operated ear and were treated. However, a similar percentage developed vertigo during the packing of ear while thrice the amount developed caloric vertigo during suction of cavity which required intermittent cessation of the activity to alleviate the symptom.

Discussion

Modified radical mastoidectomy is an effective method to manage cholesteatoma in single-stage approach. However, Cholesteatoma recurs in 4 to 28% of cases. This is caused by inaccessible disease left behind or remnant of matrix which got amputated during surgery ⁽¹⁾. Though we did not encounter this problem a, long term follow up of 5 years in a Danish study found that Adults and paediatric recurrences were alarmingly 15% and 37% respectively ⁽³⁾. We may probably need further follow up of our subjects. Improvement of hearing in our study was assessed by means of reduction of Air Bone gap, which was by a 6.124dB. A 8.8dB gain was recorded by B.Y. Praveen Kumara.et al., 8dB gain by Shretha, 6.09dB by Kabdwal ⁽⁴⁾. Our values closely stacked against these data from similar socio geo economic niches.

Extension of cholesteatoma was extensively studied by Ghodrat Mohommadi et al. ⁽⁵⁾ In their elaborate study depicts the wide spread of this ailment. They found tegmen involvement in 27.1%, Oval window in 46.7%, Round window 38.8%, Hypotympanum 35.5%, Tympanic sinus 40.7%, Facial recess 25.6%, Mastoid tegmen 39.8%, Sinodural angle cell 1.6%. We encountered Oval window 20%, Round window 10%, Hypotympanum 9%, Sinus tympanum 20%, Facial recess 20%, Central Mastoid cells 26%, Sino-dural angle cell 32.5%. Comparatively the disease spread in our study was more directed towards attic 62.5%, supra tubal recess 45%, antrum 52.5% and central mastoid air cells, sinodural angle cells rather than towards retro tympanum, mesotympanum, hypotympanum, and the Eustachian tube. This discrepancy may be multifactorial like geographical, racial, pneumatization and time of intervention. Similar findings of relative sparing of the meso and hypotympanic cavity compared to attic, antrum was identified by Aero in 1993. ⁽⁵⁾

Intra-operative perilymph leak was noted in 22.2% cholesteatoma patients in a paper by Prem Sagar et al in 2017. He claims Labyrinthine fistula to be resulted from cholesteatoma to be around 4-12% ⁽⁶⁾. We had 2.5% of this category of complications which developed significant bone conduction loss post operatively. Our low perilymph leak rate may be due to the specific pattern of disease spread unique to our cohort with the relative sparing of middle ear.

Taste alteration secondary to chorda tympani damage was significantly higher among our patients at a glance which was a mammoth 42.5%. Taste alteration of lesser magnitude was observed by E Kiverniti et al ⁽⁷⁾ which was nearly half of ours. Similarly, somewhat low figure of 26.66% was reported by S Manadhar et al from Nepal ⁽⁸⁾. The high initial values in our audit could reduce with time though the author finds this as a significant weakness in intraoperative technique needing further refinement.

Erosion of ossicles is a common finding in mastoid surgery in medical literature. In a study by Olga Papadopoulou et al it was found 88% of malleus bone had some form of erosion while we encountered head of malleus erosion to be 27.5%. Their study found evidence of incus erosion in 81% and to be the highest affected and ours was 55% and similarly the most affected ossicle. Amongst our patients, stapes was unaffected in 90% and contrary to their find of 54.5% to have unaffected stapes bone ⁽⁹⁾. Again it may primarily be due to the epitympanum based distribution of cholesteatoma.

Exposed Facial nerve in a middle ear has been an enthusiastic topic and there is a lot of data published about this. 55%-56% of dehiscence has been observed in temporal bone studies ⁽¹⁰⁾ However, rather low values were demonstrated by surgeons. Statistics of 8.9% ⁽¹¹⁾, 11.4 ⁽¹²⁾, 17.1% ⁽¹³⁾ were reported and our findings were in the same scale of the later at 10%.

Location of Sigmoid sinus in relation to posterior ear canal wall seems a limiting factor in gaining adequate access to medially placed mastoid cells and cholesteatoma. We found 10% (4 patients) to have anteriorly placed Sigmoid sinus without any mastoid air cells between posterior wall of External ear canal and anterior wall of Sigmoid sinus from tegmen to Juglar bulb. Though this may be considered a non-significant finding this will act as a deterrent in enlarging the fossa mastoidea in Mastoidectomy. We found 10% of our patients to be afflicted with this and extra vigilance was adhered to prevent accidental damage to the sinus. We could find only one literature about this mentioning a 14%⁽¹⁷⁾ for comparison further work may be needed here.

The relation of facial nerve to oval window is an encounter that is more discussed in relation to stapes surgery. However, we found 3 patients (7.5%) to have a dehiscence facial nerve with an overhang creating a dilemma in placing the TORP or reinforcing the temporalis graft with cartilage over the stapes head as they could rest on the nerve. 5.37% of similar findings were documented by M Ballesteret et al⁽¹⁴⁾. We found this figure at 7.5% and apparently there seems to be less of a discrepancy with the global statistics.

Dural exposure among our patients due to cholesteatoma was 2.5% and was seen in a revision surgery of congenital cholesteatoma which the initial surgeon had documented as well. However, greater values of 6.5% have been reported with CSF leaks and even with Meningocele in literature and we feel blessed for encountering such low figures of this dreaded finding.

Dizziness following mastoidectomy is a debilitating symptom. A report of 3 out of 34 patients developing dizziness after CWDM is reported by⁽¹⁵⁾ John P Lionetti, while 7.5% developed Dix hall pike positive BPPV in our sample post operatively. Caloric effect following suction of cavity was noted around 54%⁽¹⁶⁾ by Beutner Drik et al while our 's was for packing and suction 7.5% and 22.5% respectively which is well within reported range.

Conclusions

The improvements in hearing when adjunct with Tympanoplasty in this audit keep up with recent compared studies. Further the ability to safely achieve a disease free ear is endorsed and complemented by the low complication rates. It also testifies to how prudent it is to use MRM (from the intraoperative evidence) to treat damage attributed to Cholesteatoma, especially in extensive cases. The study confirms the value of long post-operative follow up to accomplish a safe dry cavity and minimum vestibular effects proves the tenability of patient friendliness of this age old procedure.

Key Messages

Our Modified radical mastoidectomy findings follows closely with the published data internationally. However, it seems prudent to follow them up further for recurrence. Furthermore, delicate and conscious attention needs to be paid for preservation of sense of taste in handling chorda tympani.

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